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The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Newcastle—Men and Matters

ORTH-EAST England is singularly rich in natural chemical deposits. Between the brine fields of the Tees and the Border lie greater re- ces than can be found in any other part of England. only fitting therefore that the Society of Chemical istry should, for the fourth time in its history, hold Annual Meeting at Newcastle-on-Tyne, the capital North-Eastern England. Northumbria, dependent he heavy industries, has suffered more than its fair e through the world depression in trade. North- rians are however a sturdy race and they are not ing apathetically for a problematical revival in the stries for which their locality won its fame. Rather they turning their attention to research work with w to devising new outlets and uses for their products. us take a look at the people and places we shall next month. It is not difficult to assess the causes h led to Northumberland becoming famous for its rt trade. The principal coal seams and the coast- lie parallel to each other, running roughly north south. At right angles run the rivers, providing transport to the sea and harbours for the shipping. n those rivers for centuries trade has flowed from thumberland to the ends of the earth. With un- ed coal for power, facilities for transport, and ral fields from which the caustic soda could be lied for a soap industry, Northumberland has always a vast storehouse of natural energy. Science has d its natural home in such surroundings. Armstrong ege, which might be described as an outcrop of the ent University of Durham, is famed for its Faculties ngineering, of Marine Architecture, and of Science. ng the past fifty years science in the No... has rred a great debt to one man in particular. For a cen... he has encouraged research workers and ired the scientific workers in many industries by personal example. He is Dr. J. T. Dunn, our ident-elect, and it is only fitting that his inexhaust- energy, his wide knowledge of men and matters, his selfless devotion to the cause of science, and his modesty should be rewarded by the Society paying him the highest honour that lies within its power. Fifty-three years ago he became Secretary of the Newcastle Chemical Society, but readily sacrificed his position for the general good when it became apparent that benefits would result from merging the Newcastle Society in the larger Society of Chemical Industry. Dr. Dunn is not only a scientist; he is a noted musician, a shining light of the Literary and Philosophical Society, a member of the Council of Armstrong College, a Justice of the Peace for Gateshead, and Public Analyst for the county of Northumberland. Much of the responsibility and the bulk of the work of organizing the Annual Meeting falls upon the Honorary Secretary for the district. Newcastle is fortunate in having so energetic and capable a worker as Mr. J. W. Craggs. He is that rare combination, a scientist and a business man. In the few intervals when he is not organizing his business or dealing with the hundred and one calls on his time imposed by the work of the Society, he finds his relaxation in casting a fly over the turbulent waters of some Border river. Another man who is working hard for the success of the meeting is Dr. G. E. Stephenson, a brilliant research worker, who has recently returned to this country after holding a Fellowship in America. Much of the great reputation which Armstrong College has achieved is due to Prof. G. R. Clemo, the Professor of Organic Chemistry there. Armstrong College will form the focal point for the Society's activities during the week which begins on July 10. Sir W. M. Marris, its distinguished Principal, will play an important part in the proceedings, while Prof. Clemo has lent one of his laboratories for a most interesting exhibition designed to show the progress of chemical science during the past fifty years. This exhibition is being organized through the energy of Mr. B. P. Hill, of Blaydon Manure & Alkali, Ltd., and will include a representative collection of such new products as tellurium lead and the fused silica which is now being used for domestic as well as industria

purposes. It would be impossible to visit Northumbria without mention of Billingham, the huge works which Imperial Chemical Industries have erected on the banks of the Tees. In the Research Department here, Mr. Appleby exercises benevolent despotism over a large number of distinguished research workers. Coal and Newcastle are synonymous in the public mind and it is impossible to think of coal without thinking also of Emeritus-Professor Henry Louis, the famous Secretary of the North of England Institute of Mining and Mechanical Engineering, who has more letters after his name than a Field-Marshal. It is unnecessary to mention that he is a past-President of the Society of Chemical Industry, as well as a past-President of other distinguished bodies. If and when prosperity returns to Tyneside, much of the credit will be due to the energy shown by Colonel Andrew Henderson, C.M.G., Chairman of the Tyneside Industrial Research Conference. Although he was nearly fifty years of age when the war broke out, he took his battalion of the Durham Light Infantry to France in time for the second battle of Ypres, where he was twice mentioned in despatches, and later to Salonica, where he again gained distinction. Then there is Mr. R. P. Sloan, C.B.E., Chairman of the North-Eastern Electric Supply Company, the vast power company which supplies the North with electricity from the Border down to York. Of this company, the Parliamentary Secretary to the Ministry of Transport recently said in Parliament, that it " is a model which we should like to see the whole of England follow." Lean, grey-haired and with a dominant personality, Mr. Sloan, from his room in the centre of Newcastle, directs a system extending over five thousand square miles of country and a firm which supplies electric light to every conceivable type of consumer, from the miner in his cottage to the vast factories of Darlington, Middlesbrough, and Stockton.

The Chemical Engineering Group

The Proceedings of the Group for the years 1931 and 1932 (Volumes 13 and 14) have just been published and they contain, as might be expected, a number of valuable papers on a great variety of topics. It is possible that it would be a convenience to many people if a classified list of the papers included in the Proceedings from their commencement were issued; such a list would not be very expensive to prepare and it would save turning over the pages of a number of volumes. It is so easy to forget both the name of the author, the title of the paper, and even the year of its publication. To indicate how wide is the range covered by the group we will give a few examples: on general engineering there have recently appeared papers on Gas-Heated Furnaces by C. M. Walter (1929), Welding by J. R. Booer (1930), Electric Furnaces by A. G. Lobley (1930), Modern Grinding by J. C. Farrant (1931), Heavy Oil Engines by S. J. Davies and E. Giffen (1931), and High-Speed Compression Ignition Engines by C. B. Dicksee (1932); on metals and metallurgy there have been many papers: Safeties of Mild and High-Tensile Alloyed Steels by B. P. Haigh (1929), Caustic Embrittlement, in boilers and steel, by W. S. Coates (1930), Silver by D. McDonald (1931), Platinum by D. McDonald (1931), Metal Alloys in Leather Manufacture by D. J. Lloyd (1931), Measuring the Mechanical Properties of Metals by L. H. Hounsfield (1932), Nickel by W. R. Barclay (1932), Special Alloy Steels by T. G. Elliot, R. J. Sarjant, and W. Cullen (1932), and the Corrosion of Metals by G. D. Bengough (1932); the fuel papers include Coal: Smokeless Fuel and Oil by W. R. Ormandy (1931), and Colloidal or Coal–Oil Fuel by J. S. S. Brame (1932); there are two papers by W. Clayton on the Preparation of Emulsions (1932) and Emulsion Persistence (1932); there are two papers on catalysis: The Specific Activity of Catalysts by E. B. Maxted (1931), and Specific Catalytic Surfaces by E. K. Rideal (1931), and there are many other important papers in the last two and the previous five or ten years the enumeration of which would occupy much space and not afford very bright reading. The instances we have given show that very much valuable information is contained in the Proceedings of the Group and how important a storehouse is a series of these volumes. They are not confined to matters of chemical engineering for there are also papers on matters of general interest of which Sir Richard Gregory's Science in Industry (1931), and Sir Robert Horne's Currency and Prices (1932) are examples.

War Debts

We read a few days ago in *The Times* a quotation from a speech made by Mr. Henry Bell, the well-known banker, in February, 1912, which is so remarkable that it is worth reproducing, especially at the present time when the question of war debts is very urgent and interesting. Mr. Bell said: " I have often wondered why Mr. Angell, in that powerful book of his, did no more insist, if indeed he insisted at all, upon the great spectre which will rise up in future before the monied classes when they are invited to lend their money for warlike purposes. There is going to be very clearly written in the handwriting on the wall a word which is called ' Repudiation.' If the nations are going to spend thousands of millions for warlike purposes, the people of those nations are going to be crushed by a weight of taxation which they simply cannot bear. To-day, even for the preparation of wars that do not take place, the nations of Europe are overburdened with taxation. And if it is remembered that we spent something like 300 millions upon a comparatively small war in South Africa, and then reflect that a great European war would run into thousands of millions, and that those thousands of millions would constitute a debt upon which interest would have to be paid year after year in perpetuity, I believe the peoples of Europe would say this: ' We know we ought to pay our interest; we know we ought to pay our debt; but we cannot. We are human beings, and must live; we are overtaxed; we cannot get enough to eat; we cannot get enough to clothe ourselves; we can get no profit from our work.' I am forced to believe, reluctantly if you like, but quite certainly, that the men who find money for the purposes of war will not get their money back again." Twenty-one years after this speech was made we are learning the truth of Mr. Bell's observation and it is a pity that we did not believe him earlier.

PHOTOGRAPHIC SENSITIZERS

By H. V. HORTON, B.Sc.

An ordinary photographic plate, which has not been ,eated with sensitizing dyestuffs, is sensitive chiefly the blue-violet portion of the spectrum. It is obvious at photographs prepared from plates of this type ill give a hopelessly incorrect black-and-white rendering colour, but the surprising thing is that in the majority cases the eye does not readily detect the error. One the most glaring cases is the result obtained when an tempt is made to take a photograph of a yellow ject: to the eye yellow is a very light colour, but to e ordinary plate it is almost black. Whilst it is mewhat difficult to decide what is true black-and-hite rendering of colour, there is a general agreement ithin certain limits. It might be interesting, in this nnexion, to see to what extent a colour-blind subject ould agree with the camera's translation of colour into lack and white. The action of light on the silver lide particles, which, emulsified in gelatin, constitute e sensitive film, is still imperfectly understood, but hatever it may be, it results in the silver halide becoming reducible by the very weak reducing agents known as evelopers.

One of the earliest improvements to the photographic late consisted in adding a dye to the emulsion (erythrosie was and is still often used) which resulted in the late becoming sensitive to green light as well as to lue-violet: these plates are called orthochromatic; ney are relatively insensitive to the red end of the pectrum. The discovery of dicyanine (the first real nfra-red sensitizer) and of sensitol red, in 1906, marked he commencement of sensitizing to the red end of the pectrum. Since then many derivatives of the cyanine yestuffs have been prepared. Plates treated with these yes, either by adding the dye to the emulsion before oating, or by bathing the plates in dye solution, become ensitive to the whole visible spectrum and, in certain ases to the infra-red: in the former case the plates are nown as panchromatic. For many years freak plates ave been known and have been used for special scientific urposes, for photography in the infra-red and the ultra-iolet, but it is only comparatively recently that plates ighly sensitive to the infra-red have become practicable ommercially. The problem is not only to obtain dyes which will sensitize plates to infra-red radiation, but to ind methods of adding dyes to the emulsions which will iot destroy other properties of the emulsions, and also o obtain the high degree of sensitivity (speed) necessary or ordinary photographic purposes: in addition, and his is perhaps more important than any other consideration, the plates must have good keeping qualities. n most cases of infra-red and red sensitive plates the ensitivity to blue light remains, so that when it is lesired to use these plates for infra-red work, either he object must be illuminated by infra-red light only, or a filter which will transmit only infra-red radiation must be placed in front of the lens. The first procedure is adopted in laboratory work, but the second one is the only possible one for outdoor photography.

Apart from the obvious use of infra-red photography in connexion with spectroscopy, many uses in connexion with the examination of materials have been developed. Two materials which, visually, may appear to have the same colour, frequently show considerable differences when examined by infra-red photography. The detection of forgery is possible by this method just as it is by ultra-violet light methods. The hazy outlines of distant objects are due to the scattering of light of all wave-lengths by particles of dust and moisture present in the atmosphere. This scattering is most pronounced for light of short wave-length: for infra-red radiation (*i.e.*, radiation of wave-length greater than 7700 Å.) the amount of scatter is very small. If a photograph is taken with a plate sensitive to infra-red radiation, and if the scattered light of lower wave-length is eliminated by the use of an appropriate filter, a sharp photograph will result even when the scattering of visible light is sc great that the distant object photographed is not visibl at all. The resulting photograph is as far from being a correct black-and-white record of the view as was a photograph taken with a blue-sensitive plate, but ir certain cases this is not a serious objection. It must be remembered that sensitivity to infra-red radiation mean sensitivity to heat, and plates have been prepared tha are so sensitive to heat that precautions must be take to prevent undue warmth.

The dyes which are used for sensitizing to the red an infra-red consist chiefly of compounds containing two o more heterocyclic nuclei, joined by carbon chains o varying length, and having various substituents. Amon those most in use may be mentioned kryptocyanine which confers a maximum of sensitivity at about 7500 Å and consists of two substituted quinoline nuclei joine by a three-carbon chain, neocyanine, which confe maximum sensitivity at 8200 Å. in the infra-red and ha three quinoline nuclei in its molecule, and xeno-cyanin which has two substituted quinoline nuclei joined b a seven-carbon chain and which sensitizes to wav lengths up to 11,000 Å. Very many derivatives of thes cyanine dyes have been prepared: some are sensitize for the infra-red, some sensitize to other portions of th spectrum, and others do not sensitize at all. Th mechanism of sensitization is still the subject of muc speculation, but there is yet little definite knowledg In the chemistry of dyestuffs indications of the effe of substituents have been obtained which are of assis ance in attempting to synthesize new sensitizers. Th very great increase in the amount of research in the problems in recent years leads one to hope that befo long solutions may be found.

SOME TYPES OF UNBREAKABLE RECORDS

By H. COURTNEY BRYSON

An ordinary gramophone record represents t present-day high-water mark of moulding techniq For beauty of finish and accuracy of reproduction the is no other commercial object that can compare with A thin flat disc is one of the most difficult articles mould, and in fact serves as a test for a mouldi material. In what the Americans term custom moul ing, a toleration of variation is 2/1000—5/1000 in., b

* Read before the Plastics Group on Nov. 30, 1932.

for a gramophone record the limits are 50 times as precise and the reason for this will be dealt with later.

Unbreakable gramophone records may for convenience be divided into two types, the division being on a structural basis. There are, firstly, those which are homogeneous throughout, and in general made by a process of true plastic moulding, and secondly those which possess a central core which differs in composition from the outer surface and which in general are made by a process of stamping. Like most of such classifications, this division is not precise. A search of the patent literature seems to indicate that the latter type has been more prolific as far as ingenious modifications are concerned, and we will make a very brief examination of some of the varieties which have reached commercial production. At first glance it might be thought that the production of laminated records involves little more difficulty than that of ordinary solid records, but this is by no means the case, since there are a number of additional circumstances exerting a profound influence. In the first place, if the central core is not thoroughly waterproof or at least of a water-resisting material, moisture from the air is always liable to enter by the edges and cause changes in volume, which changes are naturally transmitted through to the surface layer. The magnitude of such changes need only be minute in order to produce marked changes in reproduction. The normal record is cut with about 100 grooves per inch, and the maximum deviation from the mean line by the recording stylus is therefore about 2/1000 in. The process is so arranged that the maximum amplitude of cut is 0·002 in. at 250 cycles, and since the amplitude varies inversely as the frequency, it is easy to calculate that at 5000 cycles at the same intensity the amplitude is only 1/10,000 in. In other words, a movement of even 1/10,000 in. in certain directions in the surface is capable of producing audible results. The first essential is therefore to ensure that the inner core is not affected by the atmosphere. This may be done in two ways, either by making the material waterproof or by sealing the edges to prevent the ingress of air. Even if the core remains always anhydrous it must have certain other properties: for example, if it is very rigid and has a coefficient of expansion very different from the outer layers then there is danger that temperature fluctuations will cause either splitting or distortion.

Another difficulty relates to the non-plasticity of the core. As far as I am aware, the Columbia record, besides being the finest record ever manufactured by any company anywhere, was also the only commercial record to have a fully plastic core. Not being unbreakable and also being no longer manufactured in this country, it does not come within our scope. The non-plasticity of the core results in rapid wear of the stampers which, being of soft electrolytic copper, are not capable of standing up to high pressures. In the manufacture of ordinary solid stock records, no great distortion of the stamper takes place; erosion merely occurs as the composition flows outwards, and this erosion takes place roughly at the rate of about one-2½ millionth part of an inch per record. Where very hard and non-yielding materials are dealt with, the stamper is also liable to blister, the nickel coming away from the copper in a number of small excrescences. If an attempt is made to cushion the violent blow of 50 tons or more to which the stamper is subjected by placing a cushioning material such as a sheet of lead under it, this cushioning material will itself eventually flow outwards and build up round the edges. As a slight compensation, since the operation is essentially a stamping one and no flow of plastic material takes place, the need for holding-down rings which secure the stamper to the die and trap the material, with some of their attendant troubles, is eliminated.

Almost every material which has been proposed for gramophone records could be placed in one of four classes: (1) Natural resins (including rubber in this division). (2) Synthetic resins. (3) Cellulose derivatives. (4) Metals. Materials such as protein, *e.g.*, casein, which do not fall into any of the above classes have occasionally been proposed for records; with the exception of gelatin which achieved a small sale in France for home recording, they all possess fundamental defects rendering them useless for the purpose at issue.

Commencing with natural resins, there is one which by virtue of its hardness, its plasticity, its strength, and its good moulding characteristics, occupies a place which transcends in importance all other natural resins. This is shellac. Many millions of unbreakable records have been manufactured possessing a surface containing shellac as the chief binding medium. The process of manufacture in brief is performed in this manner. The materials for the surface, consisting of about 25% of shellac, 2% of gum copal, 35% of rotten stone, and 35% of barytes with some carbon black are made into a thin paste by means of methylated spirit. This may be done in a number of ways; in one particular case the mixture is placed in a barrel which is rotated for a few hours. This lacquer is then spread by means of rubber printers' rollers on black sheets of paper about 9 or 10 thousandths of an inch thick. The method of getting rid of the alcohol is effective, though bizarre; it is simply burnt off. As the coated paper discs come forward on conveyor bands from the coating rollers, they pass under a series of gas jets which ignite the alcohol vapour. The flame is quenched by passing under a sort of canopy, and the discs are again passed through the printing rollers until a coat of the desired thickness is built up. The coated sheets are then taken to the press shop and pressed on either side of a piece of board. In this particular case, when the records were first put on the market, about 1923, the board was not properly waterproof, and the consequences were those which have been previously outlined. Subsequently, a water-resisting board impregnated with bitumen was substituted, and the results were eminently satisfactory. A second piece of thick paper is interposed between the so-called thermo-plastic board and the outer coated sheet in order to act as a buffer. From the point of view of the process, it is economical inasmuch as only 75% of the amount of heating and cooling media is necessary as compared with a solid stock record. The pressing process is practically identical with normal records. A label is placed face down on the centre pin of the bottom die, followed by a sheet, face down, of the coated paper, which has been previously warmed

on a hot plate, the buffer sheet and the thermoplastic board, the second buffer sheet, the second sheet of pre-warmed coated paper face up, and lastly the top label, face up. It should be noted that the construction of the die is rather simpler when this type of record is made, since instead of there having to be a floating centre pin in the top die on which to anchor the top label, the bottom pin can be slightly lengthened and the whole pile of discs with labels placed on it. The top or movable head of the press is then brought down and simultaneously and automatically the steam is turned off and cold water turned on through the dies and a few seconds later the press is lifted and the record ejected.

On removal a weight is placed on the just warm record till it is quite cold in order to prevent any possibility of warping, and it is then trimmed up in a chuck in the usual way, and as an additional precaution the edge is usually finished up by rubbing it lightly with black carnauba wax as a sealer.

The next type of record is on rather different lines, and represents what I consider to be an interesting technical achievement; interesting because there is nothing in common between this process and the one for the manufacture of standard solid stock records. The surface is made from a resorcinol-formaldehyde synthetic resin and the history of its evolution is not uninteresting. During the war Germany was short of dope for aeroplane wings, and a resorcinol formaldehyde resin was used in place of the usual acetate. After the war, it occurred to one ingenious individual that gramophone records might be made from such a resin and some fairly successful experimental work in Germany resulted in a small factory being erected in London. Operations were commenced at a lucky period, for a few months later the gramophone record boom started with the floating of the Goodson record about which I shall have more to say later. A company, "Worldecho Records, Ltd.," was floated, with a capital of £125,000, and within a short period the shares had attained very many times their original value. The factory turned out many millions of "post-card records" prior to the collapse of the company. Shortly afterwards the "Durium" record was brought out in America, putting out one title only each week (the "Hit-of-the-Week" record). In this process gas-heated presses are used and six records are pressed at once, the cycle occupying about 10—15 seconds. After this had been running in the States for nearly two years, the process came back to England and was sold here, and Durium records are now being produced at Slough. They are recorded with about 200 cuts to the inch instead of the normal 100; the consequence is that the playing time is doubled so that two tunes of normal length may be recorded on one side. The records are not quite flat and this is explained by the process of manufacture. Although there are some three companies in various parts of the world making records by this process, no two of them follow the same plan, so that a method of manufacture may be synthesized in order to outline the general facts. A resorcinol-formaldehyde resin is first made by reacting on dihydroxybenzene with formaldehyde. The reaction is very much more vigorous than the corresponding one with phenol, and consequently is difficult to control. The method of the reaction is best performed in a closed pan, as formaldehyde is freely liberated and the quantity of formaldehyde is added in two stages, the first addition being such that a non-reactive resin results. The balance of the formaldehyde, part of which may conveniently be in the form of paraform dispersed in alcohol, is then added, so that a potentially reactive resin dissolved in spirit results. The viscosity and the rate of reaction vary directly as the amount of catalyst present, and the exact stage in the proceedings at which it is added affords one method of control. When the resin is made the modifying agents are added. Records of this nature suffer from needle drag due to the relatively high coefficient of friction between steel and resin, and a lubricant such as glycerin, glucose, soap, or cellulose acetate must be added. Rouge is also often added in order to act as a mild abrasive and reduce record wear. The solution of resin is then used to impregnate soft absorbent paper sheets—a typical and suitable paper being a low-grade filter paper. Another and a better method is to use a multiple-ply made up of sheets of fine tissue. After impregnation, which may be performed either automatically or manually, the paper is dried, and the greatest care must be exercised during this operation, for if too dry the resin becomes cured and will not take the impression and if not sufficiently dry then the time required for pressing is excessive and a bad record results. The rate of drying may of course be controlled by the proportion of solvent to resin, which also very obviously controls the amount of resin deposited in the paper per unit area, and this correct amount for any given set of conditions must be found by experiment and rigidly adhered to. The impregnated discs are then placed on backing discs and placed in the press. These latter are made from either fibre board or cardboard, and it is essential that they should be homogeneous and entirely free from knots and moisture. The effect of the presence of water will be considered in a moment. The backing disc and the superimposed paper layer are put in the press and the latter closed. The type of press employed varies from presses similar to gold blocking presses and ordinary crank presses to hydraulic presses. The preparation of the press is extremely important for no flow takes place and consequently the material itself cannot compensate for even small deviations from the plane.

The temperature at which the pressing operation is conducted is constant, the most suitable heating medium being electricity, and curing should be practically instantaneous. If the cure is not instantaneous, prolonging the time will not improve the record. Since there is no cooling and the pressing is performed at a fairly high temperature, there is always danger of blistering, and it is for this very reason that so far neither in England nor America have double-sided records been made commercially by this process. When single-side records are made, the relatively large area of the back permits the escape of vapours which would cause blisters if both back and front were impervious. Even so, a certain number of rejects always occurs, owing to the backing disc being not sufficiently dry and the moisture not being

able to escape sufficiently rapidly from the edges and back.

Quite recently however, a method has been found of overcoming the difficulty and double-sided records are now being sold in France. The advantage of double-sided records is two-fold for the warping difficulty is largely obviated. When a single-side record is pressed there is on extraction powerful shrinkage, which makes the record curl. In order to flatten it the back may be painted with a special varnish or a piece of paper may be pasted over the back.

Cellulose derivatives.—The only two derivatives of cellulose which have yet reached general commercial importance are the nitrate and the acetate, though in the near future interesting developments may be expected from ethyl cellulose. Some of the earliest records ever produced were made from celluloid and at a later date the Goodson record was made. Records made from celluloid are from the point of view of the user better than those produced from acetate, since being harder there is less needle drag and in addition the surface is less liable to tear up. Unfortunately from the manufacturing standpoint there are a number of restrictions on celluloid which render its manipulation difficult, and in addition the excessive hardness causes rapid deterioration of the stampers, the grooves becoming distorted and the surface covered with small blisters. Celluloid is only pressed with difficulty at a constant temperature and so the practice was (for celluloid records are now no longer made) to press a superimposed pile of records at a temperature of about 230° F. in a multiple-platen press at a pressure of about 1 to 1½ tons per sq. in., allowing 6 records to each of 6 daylights and then to transfer to a cooling press. Celluloid with a design, picture, or wording printed on the surface, or laminated records with a coloured picture sandwiched between two clear sheets of celluloid have been used for advertising purposes. For the reasons indicated celluloid has now been completely replaced by acetate.

Acetate records have been successfully and commercially manufactured in most of the important countries of the world. The process of manufacture is simple and possesses the attraction that no elaborate mixing and grinding plant is required while the output is comparatively high and in certain cases records have been pressed in the short space of ten seconds each. Blank discs may be purchased 0·02 in. thick in most colours punched out in circles with a centre hole ready to put in the press. In addition, the expensive dies used for solid stock records which cost £25 per pair may be dispensed with and replaced by simple electrically heated platens and the records pressed at constant temperature, which varies with the softness and plasticity of the acetate, but is usually about 80°—100° C. The bottom die is run at a slightly higher temperature than the top one, firstly because it heats up less rapidly owing to its position, and secondly if the top die is at a higher temperature the pressed record will tend to adhere to it more readily than to the bottom one.

The title may be inscribed on the surface of the disc in 3 ways. Firstly it may be engraved on the recording wax and then filled in on the record afterwards; secondly it may be printed on the surface before pressing if the quantities are sufficiently large to warrant it; thirdly it may be stencilled or printed on after pressing.

The obvious advantages of a thin, light unbreakable and non-inflammable record are off-set by the quality. Other things being equal the quality of a given record varies directly as its thickness, specific gravity and stiffness. The softness of acetate which is so advantageous for pressing is quite the reverse when it comes to playing. The needle proceeds on its course by receiving a series of blows from the undulations. If the groove walls are resilient they will deflect and distortion of the reproduced sound will result. This effect is greatest at high frequencies where the mass reactance component of the impedance predominates.

The needle rests on the bottom of the groove with a pressure of many tons per sq. in. This is essential in order to obtain good coupling between the needle point and the record grooves, especially as high damping is necessary in order to assist the return of the needle to the neutral position at low frequencies.

The coefficient of friction between acetate and steel is high so that this factor and the previous one working together are liable to result in the tearing up of the grooves in the soft acetate. To overcome this the pressure per sq. in. is decreased by increasing the bearing surface and thus we have the trailing needle. The use of such needles leads to attenuation of high notes since the length of the oval in contact with the record is comparable with the wave-length of the higher notes engraved on the disc and the needle cannot in consequence follow the highly convoluted sinuosities but "rides" them so that distortion is again produced.

One record which has been produced is made from a synthetic resin containing protein. In spite of the fact that it contains about 40% of a very fibrous material it is singularly free from surface noise and needle drag. It is made by carrying out the condensation of the resin in the presence of a protein, casein in this particular instance, then mixing and sheeting in something after the same style as normal solid stock records save that the machinery is heavier. The pressing is performed at a temperature considerably higher than that used for solid stock and approaching that used in the moulding of bakelite. The complete cycle occupies 60 seconds.

Finally, a problem which is still awaiting a satisfactory solution is that of home recording. It has exercised the ingenuity of inventors for a considerable period and within the last few years several excellent devices have appeared on the market which utilize the same disc and the same apparatus for recording and reproducing just as in the very earliest apparatus of Edison, Graham Bell and Tainter, and others. In order to achieve satisfactory individual recording it is necessary to have a material sufficiently soft for the recording stylus to engrave fairly readily and cleanly and yet resistant enough to secure a large number of playings without undue wear. A compromise is effected either by employing recording and reproducing points of different hardnesses or impedances or by hardening the surface of a soft material by chemical means after engraving. It is

desirable that the engraver should not throw up too great a quantity of shavings as unless steps are taken quickly to remove such swarf, either by means of a small brush or compressed air, it will clog the tool. A further qualification is that the disc should be light and strong.

On the Continent the attempt to find a material as soft as recording wax at the moment of registration and which may be almost immediately hardened to a degree approaching that of solid stock has resulted in the commercial exploitation of formalized gelatin. The stylus is of steel and practically conical and during the recording a fine continuous shaving of the gelatin is thrown outwards by centrifugal force. Immediately after recording the surface is covered with a hardening paste containing formaldehyde. Unfortunately gelatin varies in volume according to the ambient conditions and in addition the attack of the hardening agent on the surface of the record is liable to distort the fine grooves.

At the present moment metal discs are the most practicable. It is a good plan to cover these with a thin film of lubricant before recording; this is best done with a diamond or sapphire, while reproduction is achieved with a fibre needle, which will not tear up the surface. Rapid wear of the needle with consequent attenuation is a defect not yet overcome, whilst the small amount of energy, 10—20 microwatts, in the average human voice, is not sufficient to make a cut of high intensity on the record unless the acoustic energy is electrically amplified. The quality of the metal is important, aluminium–copper alloys appearing to be the most successful. Absolute homogeneity is essential in order that a constant resistance may be offered to the cutting stylus while a fairly good polish is obviously desirable.

THE PROGRESS OF METAFILTRATION

Three years ago Mr. J. A. Pickard read a paper before the London Section of the Society in which he described a new type of filtering unit, which he named the metafilter. The paper was subsequently printed in the Transactions (June 6, 1930, pp. 259 T—263 T). It is of interest to examine the progress which this new filter has since made, for it appears to have found a definite place in the laboratory and in many industrial plants with which the chemist is associated.

To review briefly the features of the filter, it will be remembered that the metafilter consists of a number of metallic strips, about $\frac{1}{2}$ in. wide, each of which is flat on one side, and on the other side bevelled towards the edges, and along the central flat portion on this side a "rib" is raised of a height generally in the neighbourhood of $\frac{1}{100}$ in. The strip is perforated at regular intervals along its length by holes which overlap the central rib. A number of these strips are then assembled to form a filter "frame" or "pack," being placed one above another, so that the perforations come into register to form channels. A typical metafilter "pack" is seen in Fig. 1. During filtration the liquid passes between the strips, which are pressed closely together, and into the drainage channels which overlap the central separating ribs. The drainage channels come into a single union at one end of the "pack." This in itself constitutes a useful filter for fairly large-sized particles, but it is converted into a filter capable of removing much smaller particles by the use of a filter-aid such as kieselguhr. This material is deposited as a filter-bed in the V-shaped intervals between the strips occasioned by the bevelled edges on either side of the central ribs. By the use of a kieselguhr of selected fineness, the metafilter has been shown capable of removing completely particles the size of water-contaminating bacteria, *e.g.*, *B. coli*, or even smaller particles such as barium sulphate down to 0·1 μ diameter. The filter-bed is easily formed on the pack by placing the filter-aid in the liquid to be filtered and forcing this through the filter-pack, when the bed is automatically

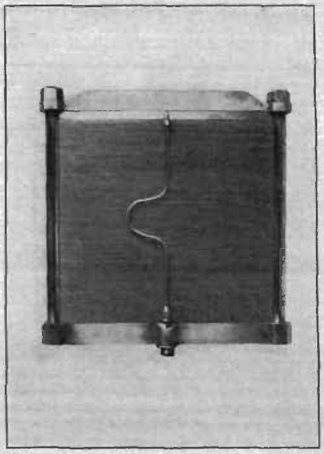

FIG. 1

Metafilter filter pack for beer filters

deposited on the pack, the liquid passing through. This filter-bed is easily removed by reversing the flow of the liquid, and the ease of cleaning thereby obtained is one of the main advantages of the metafilter over edge and pulp filters.

Manufacture of the metafilter is in the hands of the Metafiltration Co., Ltd., and for the past three or four years production has been going forward in a factory at Hounslow. Much work has been done to adapt the filter to various types of work, the results always being submitted to tests by authoritative consultants before being put into production, and such are the advances which have been made that different types of metafilter are now employed in almost every large brewery in this country and several on the Continent, in works where mineral waters and syrups are manufactured, in

hospitals for the filtration of agar-agar and sera, in laboratories for water sterilization and quick filtration processes, in power stations for cleaning transformer and switch oils, in garages for "recovering" used lubricating oil, and in many other situations for filtering such materials as gelatin, cream of tartar, varnishes, wines, alkaloids, fish oil, dyes, gums, perfumes, essences, and sugars.

Probably the biggest application to date has been to filtering beer. In the plant for this purpose a number of filter frames of the type shown in Fig. 1 are enclosed in a container consisting of a conical base covered with a dome (Fig. 2). Monel metal is used for the filter frames, and Metasil—a selected grade of kieselguhr—is used for the filter-bed. The all-metal construction gives the metafilter many advantages over the ordinary pulp filter, amongst which two of importance are the absence

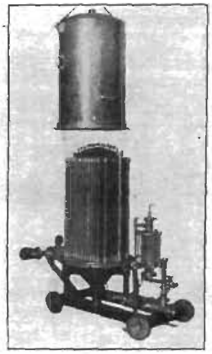

Fig. 2

Metafilter for beer. Output—100 barrels per hour

of porous parts in which yeast or bacterial growth can proceed, and the ease with which the metafilter can be cleaned and sterilized. It is claimed that the use of the metafilter for this work enables economies to be effected in labour, power, and water, whilst the condition of the beer is not affected by the filtration.

The same properties make the metafilter especially suited to the purposes of mineral water factories, hospitals, and laboratories, where continuous supplies of clear sterile water are required. Small metafilters for this type of work are constructed with the packs built up of rings instead of strips, with a single central channel in place of the strip perforations, and small embossings on one side of each ring taking the place of the raised ribs on the strips. Metasil is again used for the filter-bed. As an example of the efficient water sterilization which is obtained, the results of a test may be cited in which some well water was filtered, the well water itself developing 6012 bacterial calories per c.c. in 24 hours at blood heat as compared with only 76 developed by the filtered water. On a larger scale water filters with capacity up to 10,000 gal. an hour are constructed. For other laboratory purposes small metafilters are constructed of Monel metal, bronze, stainless steel, etc. according to the type of work required, and the containers are made of acid-proof enamelled cast iron.

Some of the most exacting tests of the metafilter have been concerned with the purification of transformer and switch oils. A typical case is a test which was conducted by a consultant on behalf of the Central Electricity Board, in which a transformer oil, the bulk of

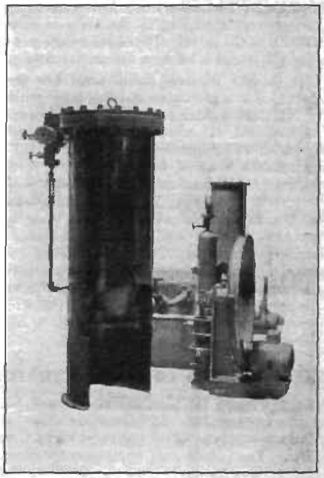

Fig. 3

Transformer oil filter

which was 20 years old, and a switch oil nearly 30 years old which had become acidic owing to the long exposure, were purified. During the test filtration was maintained at the rate of 300 gal. per hour at 57° F.; the water content of the switch oil was reduced from 0·48% to nil, suspended carbon was removed completely from both oils, and breakdown voltage was improved from zero to 45 kv. The metafilter for such work is connected to a feed pump operated by an electric motor, as seen in Fig. 3. Other work on oil purification has led to the production of a small petrol-engine operated unit for recovering crank-case lubricating oil in garages, and a small unit has been evolved for automatic filtration in the oil circulation of the road vehicle. As an example of its efficiency it may be stated that Mr. J. A. Pickard, the inventor, has used such a filter on a motor

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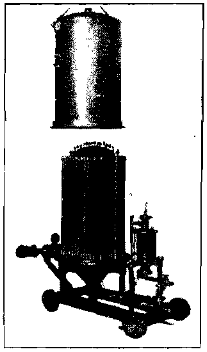

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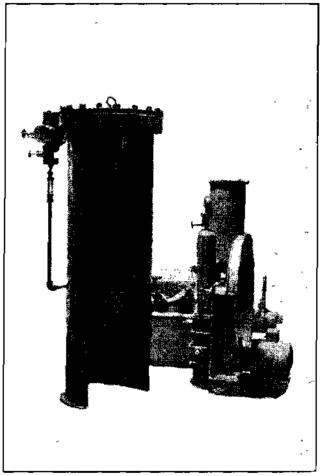

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car for 20,000 miles without the lubricating oil having been replaced.

One of the greatest advantages of the metafilter is the comparative ease with which it will deal with viscous fluids such as agar-agar and varnish which are otherwise very difficult to filter. In the varnish filter a large number of filtering packs of the columnar ring type are employed, using Metasil for a filter bed. A unit of moderate size can maintain an output of 200 gal. per hour and no cleaning is required for 10 hours. When cleaning does become necessary it is relatively easy; all that is required is to raise the packs from the body of the filter, as shown in Fig. 4, to swing these to one side, and to force some clear varnish through in the reverse direction of normal flow, where the whole filter-bed and the attached material falls away from the packs. These are then swung back into position,

FIG. 4

Metafilter for varnish—open. 80 sq. ft. filter surface

lowered into the body of the filter again, and after tightening the head and depositing a fresh filter-bed the metafilter is again ready for 10 hours' work.

The few examples which have been given serve to show that the metafilter has made considerable headway in the last three years whilst its undoubted advantages hold out considerable promise for its extended use in many branches of the chemical industry. In the factory at Hounslow work is proceeding to discover the best designs, materials, and filter-aids, for specific types of work. The filter-packs can be built of many metals, of wood, or of plastic materials, and a range of filter-aids from powdered charcoal and decolorizing carbon to powdered glass and silica can be employed to give the most desirable results. The filters can be supplied to work in closed containers under pressure or under vacuum in open containers, whilst the units are adaptable and can be built to follow the general lines of almost any other type of filter.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

Annual General Meeting, Newcastle, July 10-14. Members are recommended to apply early for reservation and hotel accommodation using the forms recently circulated by post.

Accommodation. Members are making the mistake of attempting to book accommodation for the meeting directly with the hotels instead of through the Honorary Secretary, Mr. Craggs, 4, St. Nicholas Buildings, Newcastle. This will result in delay and possible disappointment, since all available accommodation has been booked by the Society or another large organization.

New Hall, Benton. The circulated notices may not convey correct information to all readers. This very modern hostel, which is delightfully situated, has accommodation for 75, some of which will suit married people, while a wing of 12 single rooms can be reserved for ladies only.

John Gray Jubilee Scholarship. The closing date for applications is June 30.

Annual Reports on Applied Chemistry, Vol. XVII, 1932. The sales of the new volume have exceeded those of the previous year. Members who have not yet secured a copy should send 7s. 6d. to the General Secretary, 46, Finsbury Square, London, E.C.2.

SCOTTISH SECTIONS

The annual summer meeting of the Scottish Sections of the Society was held in conjunction with the Scottish Sections of the Institute of Chemistry and the Chemical Society, in Glasgow on Friday and Saturday, May 26 and 27. Members were received by Prof. F. J. Wilson, the chairman of the Glasgow Section of the Society, in the Students Union at Glasgow University. Apologies were read from members unable to attend, among these being Prof. G. G. Henderson who was unfortunately indisposed.

After tea a short paper on "Cellulose and Its Uses" was read by Dr. W. J. Jenkins of the Technical Department (Nobel Section) of Imperial Chemical Industries, Ltd., who said that cellulose was familiar to us all in its many forms; as cotton in the textile industry, as paper, celluloid, artificial silk, moulding powders and various plastics. The property which more than any other had rendered it satisfactory in these connexions was its tensile strength. The tensile strength of good quality cellulose was of the same order as that of the heavy metals: good quality steel had a higher tensile strength, but copper, iron, and aluminium were inferior in this respect to ramie cellulose.

The modern views of the structure of cellulose were briefly considered, and on the evidence available it seemed probable that cellulose consisted of chains of molecular units of glucopyranose molecules linked together through positions 1 and 4, that is primary valencies are the links in the length of the chain. The secondary or Van der Waal forces in these units bring

about the cohesion of the chains. The factors which contributed most towards the tensile strength of cellulose were the chain lengths, the interlocking of the chains, and the cohesional forces. When cellulose was heated it decomposed before any softening occurred and this showed that the Van der Waal forces were of such a strength that before the kinetic energy of the molecules had reached a value sufficient to overcome them disintegration of the molecule took place.

The lecturer explained the preparation of cellulose derivatives dealing particularly with cellulose nitrate. Cellulose acetate and benzyl cellulose were also mentioned and it was shown how the properties of cellulose derivatives alter depending on the nature of the substituting group. Great differences in behaviour were also noticed in which there was difference in the degree of substitution. Examples of this effect were given with respect to samples of cellulose nitrate of different nitrogen content. Another remarkable difference was that in viscosity of solutions of nitro-cotton of the same nitrogen content when dissolved in acetone. Some gave fairly mobile liquids while others were very viscous.

Dr. Jenkins then dealt with cellulose lacquers, or as they should be called lacquers of cellulose derivatives. The most important derivative used was cellulose nitrate, though cellulose acetate and benzyl cellulose were used to some extent. A lacquer was a clear composition used for coating purposes whilst an enamel was a lacquer which had been compounded with a pigment. An enamel was composed of a nitrocellulose base, a gum compound, a pigment base, and a thinner. The uses of these components was explained and the method of applying enamels to motor car body work was outlined.

After dealing with the solvents used for nitrocellulose and the effect of specific groups in the solvent molecule on the power of dissolving nitrocellulose the lecturer passed on to consider artificial leather cloth. The method of manufacture consisted essentially of applying a suitably coloured plastic mass of cellulose derivative to a woven (generally cotton) fabric and thereafter impressing the required grain in relief upon the product by means of embossing plates or rolls. Samples of artificial leather cloth were shown and it was explained that special cloths with antique effects were made by spray treatment.

In concluding Dr. Jenkins mentioned the use of cellulose derivatives for the manufacture of moulding powders and said that nitrocellulose was not used to any marked extent in this direction but that the use of cellulose acetate and benzyl cellulose was considerable.

In the short discussion which followed Prof. Wilson, Prof. Caven, Mr. Gunn, and Dr. Kermack took part. A vote of thanks to the lecturer was proposed by Mr. J. W. Napier.

An interesting account of Auchencruive, which was included in the visits arranged for Saturday, was given by Mr. Melville of the West of Scotland Agricultural College.

An informal dinner was served in the College Club at the University and among those present were Prof. Wilson, who occupied the chair, Prof. Patterson, Prof. Caven, Prof. Cumming and Mrs. Cumming, Dr. Jenkins, Mr. Tait, and Mr. Mitchell.

In proposing the toast of "The Chemical Industry," Mr. Ramsay said that one of the outstanding features of the chemical societies was the enthusiasm that was shown in all their work. He felt sure that we were today as good as our predecessors and that the grit of our young men would keep Scotland to the fore. In reply Prof. Caven said that the three main chemical societies were closely interlocked; the Chemical Society stood for pure science, the Society of Chemical Industry was a link between pure science and industry, whilst the Institute of Chemistry attended to the education of the practical man, analyst, works chemist, and consultant.

Dr. Tucker in humorous vein proposed the toast of "The Visitors" and Mr. Tait suitably replied. The evening was then concluded by Prof. Cumming proposing a vote of thanks to the chairman and to Mr. Jamieson, the Secretary of the Glasgow Section of the Institute of Chemistry, who had made all the arrangements.

On Saturday a party of between 70 and 80 members visited Auchencruive, which is situated about 4 miles from Ayr. Here they saw all the practical work which is carried out in connexion with the West of Scotland Agricultural College. The party visited the poultry farm where they inspected incubators of all sizes, and then passed through the chemical laboratories where all problems confronting the farmer are dealt with. In the department devoted to milk production an interesting address was delivered by Prof. Leitch on the difficulties met with in cheese production. A hurried trip through the piggery was followed by a visit to the dairy school where the latest plant for the production of butter, cheese, pasteurizing, cooling, and bottling of milk was inspected. The experimental farm and magnificent gardens proved of great interest. Lunch was taken in the Farm Hostel, and Mr. Langlands proposed a vote of thanks to the Governors, Principal, and staff of the College for making this visit possible. Prof. McArthur replied and said that he hoped that the societies would honour Auchencruive with another visit in the near future.

In the afternoon the party proceeded to the Ardeer Factory of Imperial Chemical Industries, Ltd. Here they were met by Mr. Donaldson, the works manager, and under the care of guides were conducted round the factory. The plant for the production of nitroglycerin was inspected and the scrupulous care which was taken to minimize danger was a noteworthy point. The sulphuric and nitric acids used in the nitrating processes at Ardeer are all manufactured locally, the nitric acid being made by catalytic oxidation of ammonia. The nitration of cellulose to produce nitrocellulose of different nitrogen content was another process which proved of interest to the visitors, and the tour concluded at the testing station. Here the use of different types of explosives was demonstrated. One of the most impressive tests was one designed to test the suitability of an explosive for use in coal mines. A most enjoyable tea concluded an extremely interesting visit.

CHEMICAL SOCIETY

Thirty-four new Fellows were elected at an ordinary scientific meeting held on June 1; the president, Prof. G. T. Morgan, O.B.E., F.R.S., occupied the chair.

Mr. S. Holt discussed:

Hydrates of Calcium Sulphate. [With C. S. Gibson.]

The course of the dehydration of calcium sulphate dihydrate has been reinvestigated. In the first series of experiments vapour pressure determinations were made using a differential tensimeter as described by Hartung (Trans. Faraday Soc., 1920, **15**, 150). In the second and third series, apparatus similar to that employed by Hackspill and Kiefer (Ann. Chim., 1930, [x], **14**, 227) for the study of salt hydrates was substituted for the tensimeter. Only two discontinuities at 73° ± 2° and 92 ± 2° in the temperature–vapour pressure curve were observed and the results indicate:

(1) Calcium sulphate dihyrate has a period of gradual change up to 73° ± 2°;

(2) The dihydrate dehydrates to hemihydrate between 73 ± 2° and 92° ± 2°;

(3) The water in the hemihydrate is conveniently described as "zeolitic";

(4) Dehydration of the dihydrate proceeds *via* the hemihydrate to anhydrite.

A comparison of these results with those obtained by recent investigators is made.

The president remarked that the study of Montmartre gypsum was Lavoisier's first contribution to chemistry; he also recalled investigations by van't Hoff, Donnau and Armstrong, and Davis.

Dr. R. Lessing referred to the importance of a knowledge of the hydrates of calcium sulphate in connexion with the formation of boiler scale. The non-appearance of the conventional transition point (107°) might be due to the method employed. The speaker asked whether the work gave any indication of the reason for the wide differences in the solubilities of the various hydrates and for the inversion of the solubility curve of the dihydrate.

Prof. C. S. Gibson said that in view of the large number of temperature–vapour pressure determinations carried out, the conclusion must be reached that the dihydrate is converted into anhydrite *via* the hemihydrate. Further, since the temperature–vapour pressure curve shows no discontinuity above 92 ± 2°, the hemihydrate cannot be a true hydrate in the ordinary sense of the term. The authors prefer to describe the water in the hemihydrate as zeolitic, and their conclusion as to the nature of the hemihydrate is supported by other recent physical evidence.

Prof. J. C. Philip asked whether the authors had studied the course of dehydration at constant temperature. Such a method of investigation would presumably differentiate between "zeolitic" water and normal "hydrate" water. The contrast, for example, between the "zeolitic" water held by certain dyes and the water in copper sulphate crystals had been established by studying the behaviour of the material at constant temperature in atmospheres of graded water-vapour pressure.

Mr. B. Wilsden referred to the technical importance of the work.

Mr. A. D. Cowper, who mentioned the interest taken in the subject at the Building Research Station, said that, following Le Chatelier and Davis, they had prepared the crystallised hemihydrate, and had lately determined the density and *X*-ray patterns; the material was identical with the hemihydrate of Plaster of Paris prepared in the dry way. Earlier work (after Davis) on the dehydration of gypsum at constant temperature in a stream of dry air had given no very clear indications of a definite hemihydrate point, but on rehydration in moist air the clearest possible proof was obtained. He asked what definite evidence, other than the second experiment and graph, was advanced for the existence of a change at 73°, whether the authors would describe the water in the crystalline modification of the hemihydrate as "zeolitic," and whether in their conclusions they confined themselves to the modification which is a pseudomorph of gypsum, prepared in the dry way.

Mr. Holt replied that the authors had no data available on the solubilities of the various hydrates and, in any case, the temperature was a most important factor. There is much information concerning these solubilities available in the literature. The water came off gradually and continuously from the hemihydrate, whilst when they had been dealing with a definite hydrate it came off rapidly, the form of the *p–t* curve being similar to that from 72° to 92°, and no difficulty in removal of the final traces of water had been encountered. Under these conditions a sharp break in the *p–t* curve might be expected, but it was not found in the experiments. No evidence of different forms of gypsum and its hydrates was given by the present experiments. There was no doubt of the existence of different crystalline forms of hemihydrate, as two of these can be seen, under the microscope, in ordinary Plaster of Paris. The authors had been able to prepare a crystalline substance of the formula of hemihydrate, as described by Armstrong, by the action of nitric acid on gypsum. In addition, a number of crystalline substances with water content of 20–<1% were also prepared, depending upon the concentration of the nitric acid. A further evidence of zeolitic character was the identity of the molecular volumes of hemihydrate and soluble anhydrite. The period of gradual change up to 72° had been observed in all the experiments, and it had been commented upon by most workers since Shenstone and Cundall in 1886. For the recognition of the isomeric forms of the hydrates and anhydrites, optical methods were desirable.

Dr. B. Jones discussed the following two papers:

The Rotatory Dispersion of Organic Compounds. Part XXI. Cyclic Derivatives of Tartaric and Malic Acids.

With the object of ascertaining what connexion exists between the nature of the optical rotatory dispersion (simple or anomalous) and the factors of ring formation and of free rotation round the bond joining the two halves

of the molecule of tartaric or malic acids, a careful study has been made of the dispersion of a number of their derivatives, the measurements in certain cases having been extended into the ultra-violet region by the photographic method. Evidence has been obtained that although ring formation tends to simplify the dispersion the anomalies only disappear completely when free rotation is inhibited.

Dimethyl and diethyl benzylidenetartrate are among the derivatives examined.

The Rotatory Dispersion of Organic Compounds. Part XXII. Borotartrates and boromalates.

A series of new boro-complexes of tartaric and malic acids has been isolated. Measurements of the rotatory dispersion of these compounds have been made and the significance of the results obtained is discussed.

Prof. T. M. Lowry said that the study of the origin of anomalous rotatory dispersion in the tartrates was rendered difficult by the fact that the active absorption bands were either on the borders of or within the Schumann region of the spectrum, where direct measurements of optical rotatory power could not be made. The empirical rule that the inhibition of free rotation by "bridging" eliminated anomalous rotatory dispersion appeared to be fully established but this effect could not be a direct one, since a mere relative rotation of the two halves of the molecule was not likely to influence substantially either the position or the optical activity of the absorption bands. It was therefore important to know whether the bridged compounds were characterised by the presence of only one of the optically-active absorption bands, which were concerned in producing anomalous rotatory dispersion, or whether one of these bands became optically-inactive in the bridged compounds. The real existence of these bands could be established by measurements with a fluorite vacuum spectograph, which was in process of construction, whereby the range of observation would be extended to 1400 Å., but measurements of circular dichroism depended on the use of quartz prisms and could not readily be extended beyond 1850 Å.

Mr. H. Hudson discussed :

The Rotatory Dispersion of Organic Compounds. Part XXIII. The Rotatory Dispersion and Circular Dichroism of Aldehydic Sugars. [With M. L. Wolfrom, and T. M. Lowry.]

(*a*) Measurements have been made of the absorption spectrum, circular dichroism, and rotatory dispersion of the acetates of the open-chain aldehydic μ-forms of glucose, galactose, and arabinose.

(*b*) These aldehydic sugars have a characteristic "carbonyl" absorption band at 2900 Å., which is optically active and gives rise to a lævo-rotation in the visible spectrum. This band is either symmetrical on a scale of wave-lengths or slightly steeper towards the visible spectrum.

(*c*) The "dissymmetry factor," $(\varepsilon_l \sim \varepsilon_r)/\varepsilon$, which measures the ratio of the circular dichroism to the absorption of unpolarised light, is approximately proportional to the frequency, but falls off slightly on the side of shorter wave-lengths, although this anomaly is much less marked than in the cases of camphor and of camphor-β-sulphonic acid.

(*d*) The rotatory dispersion of these μ-sugars includes (i) a lævo-rotation, due to the induced dissymmetry of the aldehydic group, (ii) a dextro-rotation, with a characteristic frequency in the Schumann region, which is attributed to the fixed asymmetry of the $>CH{\cdot}O{\cdot}CO{\cdot}CH_3$ groups. In the case of tetra-acetyl-μ-arabinose, however, the Schumann terms cancel out and the whole of the observed rotation is due to the aldehydic group.

(*e*) The partial rotation of the aldehydic group can be represented by the equation of Lowry and Hudson, which agrees with the experimental data more closely than do the equations of Natanson and of Kuhn and Braun.

Prof. C. K. Ingold inquired whether the theory connecting anomalous rotatory dispersion with free rotation between two asymmetric carbon atoms implied that the frequency contained in the term of the dispersion formula which disappears on stopping free rotation should be of the order of magnitude of ordinary molecular rotation frequencies.

Dr. J. G. A. Griffiths said that the author's suggestion that a small absorption band, associated in the case of optically active aldehydes with a small negative circular dichroism, occurs on the long wave-length side of the "carbonyl" band at 2900 Å. receives support from recent spectroscopic and photochemical work on acetaldehyde (Leighton and Blacet, J. Amer. Chem. Soc., 1933, **55**, 1766), and from unpublished work by Norrish and the speaker on suberone vapour, of which the main absorption band at 2900 Å. has a small companion on the long wave-length side.

Prof. T. M. Lowry referred to the fascinating results which were obtained when optically-active absorption bands were brought within the range of experimental observation. This had been done in the sugar series for the first time with the help of the aldehydic sugars which Wolfrom had prepared in the laboratories of the Ohio State University and which had now been examined in Cambridge by Hudson. These sugars contained a genuine aldehydic group, and were of a type which had been postulated ever since the days of Emil Fischer's work on the sugars, but had only recently been fixed in the form of methyl ethers, acetates, or benzoates. They owed their optical rotatory power mainly to the induced dissymmetry developed in the aldehydic group when in the unsymmetrical field of force round the asymmetric carbon atoms. By extreme good fortune, one case had been found in which the optical rotatory power of these fixed asymmetric centres cancelled out, so that the whole of the rotatory power of the sugar was associated with the aldehydic group. The study of this compound had confirmed in a most striking way the superiority of the equations for absorption, circular dichroism, and rotatory dispersion, which Hudson had himself developed, over all those which had been proposed and used hitherto.

Dr. R. J. W. Le Fèvre discussed:

Volume Effects of Alkyl Groups in Aromatic Compounds. Part I. Influence of 2 : 6-Dinitration on a Group $\cdot CR_1R_2Alk$. *Part II. Influence of a Group* $\cdot CR_1R_2Alk$ *on Vicinal Substitution.*

Scale drawings of 2 : 6-disubstituted-1-alkylbenzenes suggest that when the 2 : 6-substituents are Cl- or larger groups and the alkyl is ethyl or any other homologous radical interference (or even restriction of free rotation) of the alkyl may occur.

Unsuccessful experiments to detect inhibition of free rotation of Pr^{β}- and CMe_3- in various compounds are recorded.

The obvious inverse effect, that all groups larger than methyl should cause *ortho*- substitution less than methyl, is indicated. The conclusions of earlier workers on this point are reviewed.

Dr. O. L. Brady said that he had been interested for some time in the nitration of *p*-dialkylbenzenes and had had *p*-ethyltoluene under investigation. He had been led to this work by observations on the unexpectedly low reactivities of higher alkylamines which suggested that methyl occupied a unique position. Considering Dr. Le Fèvre's figures for the yield of 2-nitrocymene he was uncertain how far the 2-nitrocymene could be considered pure and not a mixture of 2- and 3-nitrocymene. The densities for the supposed 2-nitrocymene published by two different workers threw considerable doubt on the individuality of this compound. 3-Nitrocymene had not been described and one of the speaker's co-workers was at present engaged in the preparation of this and 2-nitrocymene in the pure state in order to obtain accurate figures of the nitration ratios. He asked what evidence there was for the purity of the 2-nitrocymene. Experience with the nitro-*p*-ethyltoluenes showed that it was impossible to separate them by fractional distillation and that very misleading results were obtained in orientation experiments unless one could obtain theoretical yields, since the difference in rates of reduction or oxidation of the two isomerides and in the solubilities of the products sometimes led to the isolation of but one product from what were known to be mixtures.

On the theoretical side, although volume effects must of course be considered the speaker was not certain that this was the only factor, apart of course from electromeric effects.

Dr. Le Fèvre replied that the criteria of freedom of the 2-nitro- from the unknown 3-nitro-*p*-cymene were that it all distilled within 1° and on reduction etc. it gave an acetamido-derivative, the m.p. of which was not much raised by recrystallisation. He admitted that the nitrocymene might not have been as free from the 3-nitro-isomeride as were the halogeno-cymenes mentioned in the paper, but he felt sure that the percentage of 2-nitro-cymene was well over 50%; this was all he desired to demonstrate. The results were not explicable entirely as volume effects. The causal factors which must be considered before explaining a substitution are the polarisation, polarisability, and sizes and shapes of the reacting molecules concerned. These factors assume different relative degrees of importance in various cases, *e.g.*, in the nitration of phenol the chief factor is the polarisability, in the nitration of nitrobenzene the chief factor is the polarisation, and in the nitration of alkylbenzenes the predominant factor is the steric and volume effect. In reply to Prof. Ingold, Dr. Le Fèvre said that it was not claimed that intervention of steric factors in substitutions of the kind discussed was a new observation.

BIOCHEMICAL SOCIETY

The 155th meeting of the Biochemical Society was held in the Research Laboratories of the Distillers Co., Ltd., Great Burgh, Epsom, Surrey, on Saturday, June 10, when the following papers were read:

"Production of Dimethyl Selenide by *Penicillium brevicaule* (*Scopulariopsis brevicaulis*), by F. Challenger and H. E. North. It was shown independently by Rosenheim and by Maassen in 1902 that the growth of *Penicillium brevicaule* on carbohydrate matter containing inorganic selenium compounds gave an odorous volatile organic product containing selenium. The first author did not identify it and Maassen, on apparently insufficient experimental evidence and from analogy with the supposed composition of Gosio-gas (see J.C.S., 1933, 95) regarded it as diethyl selenide.

The volatile compound from cultures of two different strains of *Penicillium brevicaule* on sterile bread crumbs in presence of sodium selenate or selenite has been removed in a stream of sterile air and separately absorbed in (*a*) aqueous mercuric chloride, (*b*) aqueous mercuric bromide, (*c*) nitric acid, (*d*) potassium platinochloride, and (*e*) benzyl chloride. The products isolated were analysed, compared as regards m.p. and mixed m.p. with authentic specimens, and shown to be dimethylselenide mercurichloride and mercuribromide, $(CH_3)_2Se{\cdot}HgX_2$, dimethylhydroxyselenonium nitrate, $(CH_3)_2Se(OH){\cdot}ONO_2$, α-dimethylselenide platinochloride, $PtCl_2{\cdot}2(CH_3)_2Se$, and benzyldimethylselenonium chloride $(CH_3)_2Se{\cdot}(CH_2C_6H_5)Cl$, identified as picrate.

The identification by Hofmeister (1894) and by Maassen (1902) of the odorous selenium and tellurium compounds in the breath of experimental animals as dimethyl selenide and telluride, while probably correct, is not sufficiently established and there exist no satisfactory data on the subject.

The substance responsible for the intense odour produced by cultures of *Penicillium brevicaule* on bread crumbs containing soluble tellurites or tellurates is under investigation.

"The Removal of Sugars from Dilute Solutions by Yeast," by Julian L. Baker and H. F. E. Hulton. Most of the recorded investigations on the alcoholic fermentation of sugar involve using a relatively small initial seeding rate and a large amount of sugar. The converse of this has received less attention, and but little is known as to the rate at which sugar disappears under such conditions.

With a yeast rate of 100 g. per g. of sugar, dextrose, maltose, and sucrose (in 0·2% solution) were completely removed in 30 minutes whilst lactose, galactose, and

arabinose were unaffected. When experimental conditions were arranged so as to permit of the removal of only a portion of the sugar it was found that the capacity of yeast to remove up to 50% of dextrose, sucrose, and maltose is approximately equal and that such removal is proportional both to time and yeast rate. If however, more than half the sugar is removed this relationship no longer holds. That this removal of sugar in relatively so short a time is due to fermentation was shown manometrically and the readings when plotted were linear.

Whilst salicylic acid completely inhibited fermentation, toluene in saturated aqueous solution did not entirely, and the belief of many workers that it does so needs revision.

S. marxianus was found to be incapable of removing any maltose from solution under conditions which allowed of a 50% removal of the sugar by *S. cerevisiæ*.

Baker's yeast readily removed dextrose and sucrose, but only 5%—15% of maltose was fermented under conditions which caused the loss of 50% or more when brewer's yeast was used. This result may be due to a deficiency of maltose in baker's yeast.

It is suggested that the experimental procedure described by the authors may be of some use in providing a delicate test or measure of the metabolic activity at various times in the life history of yeast grown or kept under varying conditions.

"The Relation of the Colour of Butter to the Nature of the Ration Fed," by S. J. Watson and W. S. Ferguson. Continuation of the work carried out in 1931—32 has shown that the inclusion of artificially dried grass (50% of the concentrate ration) in the winter ration of dairy cows raised the yellow colour of the butter almost to summer level, but that smaller proportions were less effective.

The feeding of A.I.V. fodder, a preservation product of grass obtained by the use of mineral acids, raised the yellow colour of butter to a high level, beyond that obtained by the use of dried grass, when fed at the rate of 40 lb. per head daily but increasing the allowance to 70 lb. did not increase the depth of yellow colour beyond that obtained with the lower quantity. The effect of artificially dried grass, ordinary grass silage and A.I.V. fodder in increasing the yellow colour of butter was compared, after the colour had fallen to a low level in mid-winter. Both artificially dried grass and ordinary silage raised the colour value to some extent and the A.I.V. fodder had an even more favourable effect.

It was found that Ayrshire cows differed from Shorthorns in their capacity for maintaining the butter colour at a more or less constant level when fed on a normal winter ration. The Ayrshires did not make as efficient use of any supplement capable of raising the yellow colour of the butter as did the Shorthorns and the values for the butter colour of the former breed were lower throughout the winter.

"A Note on the Chemistry of Glycogen," by D. J. Bell and F. G. Young.

"Further Data on the New Metabolism Hormone," by Casimir Funk. Since the last communication considerable progress has been attained towards the purification and stability of the product. The methods used for this purpose were presented at the meeting. A new light reaction was described which develops when the protein obtained from the injected animals (with traces of tungstic acid) is exposed to diffuse daylight. The development of blue colour which takes place goes in most cases parallel with the iodine titration, but sometimes a discrepancy is noticed which suggests that the intermediate products which form in the blood of injected animals with the new hormone, are not always uniform in nature.

In the study of the response to the injection of the hormone to rats fed on various diets it has been found that it varies greatly; it apparently affects the utilization of carbohydrates most. It has been found that animals fed on a diet devoid of vitamin-*A* yield first a higher iodine figure, as compared with controls, when the blood is analysed, this figure gradually diminishing as the experiment progresses, to give lesser response after 20 days. The study of various diets is being continued and may give an indication as to the clinical applicability of the new hormone.

"Influence of Cod-Liver Oil on the Hæmolytic Complement of Human Beings," by T. W. B. Osborn. The ingestion of a dose of cod liver oil (50 subjects) produced a greater rise in hæmolytic complement than did olive oil.

"Variation in *Saccharomyces*," by H. B. Hutchinson. An account of observations on certain races of *Saccharomyces cerevisiæ*. Morphological and physiological variation may be transitory and determined by environmental conditions such as nutrition, aeration, or accumulation of by-products or may be permanent possibly as a result of generic influences. The study, extending over a period of four years, of a number of sub-cultures derived from a single cell has afforded evidence of divergence from the character of the original mother cell as regards cell-form, physiological activity and type of growth on solid or in liquid media. Some of the cultures have acquired a definitely higher sporulation power than the parent stock; others have remained asporogenous throughout the period of observation.

"Note on the Indophenol Oxidase of Yeast," by W. G. Bennett. Keilin's indophenol oxidase is normally absent from growing yeast of the race investigated by him, while sugar is still present in the medium. Though normally present in commercial yeasts, its presence can be avoided by special nutrition. At the same time, the yeast produced is normal in enzymic activity and balance (including a normal oxygen uptake). It is concluded that indophenol oxidase is not essential to the respiratory system of the yeast, which, unlike indophenol oxidase, is thermolabile. It is suggested that the reactions characteristic of the oxidase are due to a derivative of copper contaminating a protein envelope of the cell. The above evidence has important implications in the theory of respiratory mechanism, being adverse to the idea of independent activation of oxygen supported by Keilin's work.

CORRESPONDENCE

THE VITAMIN CONTENT OF NATURAL PRODUCTS

SIR,—In your issue of January 27 you published a paper of mine under the above title.

In the course of that paper I stated that Munsell had used whole wheat as a source of vitamin-B_1 in diets devised for the estimation of B_2. Dr. Munsell has just written to me and has kindly called my attention to the fact that she used whole corn (*i.e.*, maize) and not whole wheat, and that this is perfectly clear from her published paper. I confess to having somewhat carelessly confused the American and the British uses of the word "corn." Any implied criticism of Dr. Munsell's paper on the particular score is therefore obviously null and void; however, Aykroyd has shown that corn, both white and yellow, contains appreciable quantities of vitamin-B_2, though not as much as wheat, and this fact is also actually mentioned by Munsell in her paper. In any case, even had the example chosen by me been wholly, and not partly, incorrect, that would not necessarily have invalidated my general argument.

I am, Sir, etc.,
A. L. BACHARACH

London, N.W.1
June 6, 1933

GENERAL CHEMICAL EQUATION

SIR,—On page 468 of the issue of June 2, CHEMISTRY AND INDUSTRY, it is stated by Mr. M. G. Evans that "If the groups $-CH_3$, $-NH_2$, $-OH$, and $-F$ are expressed in this condensed form they are all found to simulate the structure of fluorine."

This forms an example of the possible applications of the General Chemical Eqnation outlined in my communication on page 370 in the issne of April 28, 1933.

The hydrogen atom represented by A_1N_1, once it loses its nuclear charge becomes A_1N_0, and it is likely that this occurs when hydrogen enters into chemical combination with other elements to form a compound retaining none of the properties of hydrogen. Thus, in the case of water, $H_2 + O = H_2O$, the resulting compound retains none of the properties of oxygen or of hydrogen. This reaction would be expressed by the proposed method in the following way:

$$2A_1N_1 + A_{16}N_8 = (A_1N_0)_2 A_{16} N_{10}.$$

Taking the case of the groupings mentioned by Evans,

CH_3	becomes represented by	$A_{12} N_9 (A_1N_0)_3$
NH_2	,, ,,	$A_{14} N_9 (A_1N_0)_2$
OH	,, ,,	$A_{16} N_9 (A_1N_0)$
F	,, ,,	$A_{19} N_9$.

The similarity is shown by the number N_9 in all the substances or groupings under consideration.

The proposed method is obviously somewhat cumbersome, but it is no more complicated or confusing than some of the suggestions put forward in recent years. Moreover, as it appears to be generally applicable, it may lend itself better to mathematical treatment.

There are indications that formulæ based on this method will give some idea of the properties of the compounds expressed by them; it is well known that the elements are definitely represented by their atomic weights and numbers. A deal of development work would be needed to bring the idea to practical use.

The method is particularly cumbersome in the case of organic compounds, but if it enables chemists to elucidate some of the present-day problems, its cumbersomeness could be neglected. The element, carbon, represented by $A_{12} N_6$ could have 9 possible forms in combination, lying between $A_{12}N_{10}$ in CH_4 and $A_{12}N_2$ in CCl_4, both compounds being relatively inert as compared with the intermediate compounds, and in this respect they simulate to some extent the elements neon and helium of atomic numbers 10 and 2 respectively.

The recent announcement by Lord Rutherford of the probable existence of a positive electron is of particular interest as it allows of the inclusion of A_0N_1 as well as of A_0N_{-1} in the list of elementary units given in the original communication.

I am, Sir, etc.,
W. HARRISON

Kilmacolm,
Renfrewshire
June 8, 1933

PERSONAL AND OTHER ITEMS

The honorary doctorate of Cambridge University was on June 8 conferred on Sir F. Gowland Hopkins, president of the Royal Society, by Mr. Will Spens, vice-chancellor of the University.

Mr. B. F. Howard, managing director of Howards & Sons, Ltd., has been appointed a member of the new British Pharmacopœia Commission. Mr. Howard was the Streatfeild lectnrer of the Institute of Chemistry in 1930, taking as his subject "Some Notes on the Chincona Industry."

Mr. J. Keall was on June 7 elected president of the Pharmaceutical Society of Great Britain, after having served as a vice-president for the last year.

We regret to record the death on June 7 of Sir Walter Fletcher, F.R.S., who had been intimately associated with almost every branch of medical research in this country for the last 19 years. In 1914 he was appointed the first secretary of the Medical Research Committee, formed a year earlier, and continued to serve in the same capacity its successor, the Medical Research Council, until his death. He was a C.B. and a K.B.E. and an honorary doctor of the Universities of Oxford, Edinburgh, Glasgow, Leeds, Birmingham, and Pennsylvania.

We regret to announce the death on June 9 of Major W. C. Ball, O.B.E., superintendent of the chemical department, Chemical Warfare Experimental Station, Porton, Wiltshire.

We regret to learn of the death recently of Mr. P. J. Wigginton, managing director of Arthur H. Cox & Co., Ltd., manufacturing chemists. Mr. Wigginton was for some years on the committee of the Drug and Fine Chemical Manufacturers' Association, and during the war was a joint controller for the distribution of English saccharin.

Mr. W. P. Wilkinson, Commonwealth of Australia Analyst, has retired after 24 years' service, before which he was Government Analyst for Victoria.

Dr. L. H. Briggs, a graduate of Auckland University College, who came to Oxford in 1930, and gained the Oxford exhibition of the British Association for the Advancement of Science, has been appointed lecturer in organic chemistry at Auckland University College.

Sir William Clare Lees was elected president of the Textile Institute in succession to Mr. G. Garnett at the 23rd annual meeting of the Institute recently held in Manchester.

Dr. Alfred Rée, a founder of the Association of British Chemical Manufacturers, past-president of the Society of Dyers and Colourists, and first chairman of the British Association of Chemists, left estate of the gross value £33,941, with net personalty £33,002.

Chemical Society: Announcements

It was announced on June 1 that a List of Fellows will be published this year and issued to Fellows at a charge of 1s. Fellows are asked to notify the assistant secretary, before July 31, 1933, of any change of address or other alteration.

A volume of Memorial Lectures delivered before the Society between 1914 and 1932 will shortly be published; the volume will be obtainable from the assistant secretary (5s., post free, to Fellows).

World Power Conference

The British National Committee of the World Power Conference has made the following appointments in connexion with this year's Sectional Meeting of the Conference in Scandinavia between June 26 and July 7: To be official delegates: Sir Andrew Duncan, Sir David Milne-Watson, and Sir Harold Hartley. To be honorary official delegates: Sir Archibald Page, Dr. E. W. Smith, C.B.E., Mr. Roger T. Smith, and Mr. H. E. Mitton. As already announced, the British Government has appointed as its official delegates Mr. A. E. L. Chorlton and Dr. F. S. Sinnatt; Mr. Chorlton has now accepted appointment by the British National Committee as head of the British delegation.

It is probable that there will be a British membership of nearly sixty, forty-eight participants in the Conference having already completed application forms. Copies of Bulletin No. 5, which contains a full list of the papers to be presented, can be obtained (free) from the British National Committee of the World Power Conference, 63, Lincoln's Inn Fields, London, W.C.2.

Dyestuffs Production in 1933

Statements compiled by the Board of Trade from returns furnished by the principal British dyemakers estimate the total production of synthetic organic dyestuffs in the United Kingdom during 1932 to be 49,380,266 lb., which is a slight increase on the previous year's figure, and nearly 7,000,000 lb. greater than the output in 1930. Of the total output more than 9,000,000 lb. are acid wool colours, 7,600,000 lb. sulphur colours, 7,500,000 direct cotton colours, 7,400,000 vat colours, and 6,500,000 chrome and mordant colours, including alizarine.

The Plastics Industry Exhibition

In addition to the series of lectures already announced in connexion with the Plastics Exhibition at the Science Museum, South Kensington, a lecture is to be given at 5 p.m. to-day (June 16) by Mr. H. V. Potter, chairman of the Plastics Group, on "Plastics: Their Future."

In connexion with the Plastics Exhibition at the Science Museum at South Kensington a very useful bibliography of plastics has been prepared by the Science Library. It will be extremely useful to those engaged in the scientific and technical side of the plastics industry and copies, containing about 1400 classified references, may be obtained from the Science Museum, South Kensington, S.W., price 5s., or by post 5s. 6d.

A visit was recently paid to the exhibition by H.R.H. Prince George. He was received by Sir Henry Lyons, Director of the Science Museum, Prof. G. T. Morgan, Director of the Chemical Research Laboratory at Teddington, Mr. H. V. Potter, chairman of the Plastics Group, and Mr. W. C. Waghorne, chairman of the British Plastic Moulding Trade Association. As a keen motorist he was particularly interested in motor-car fittings made of plastic materials, but showed also his appreciation of many other exhibits.

Australian Overseas Trade

The imports of merchandise into Australia during the eight months ended February 28, 1933, showed an increase in value of 40% over the corresponding period last year, the imports during the month of February being greater than in any month since 1914, with one exception in 1925. During the eight months' period very large increases were recorded in the value of imports of earthenware, minerals, metals, and machinery, whilst drugs, chemicals, and fertilizers imports were together 50% greater than last year. Exports during the eight months' period also increased in value, although to only a slight extent: the value of zinc ores and concentrates and other metals exported was considerably greater than last year, but decreases were recorded in respect of copper ingots and matte, and zinc bars and blocks.

Canadian Tariffs

A memorandum issued by the Department of National Revenue, Canada, states that, under authority of Order in Council dated May 5, 1933, for the entry of tartaric acid crystals under the British Preferential Tariff, the requirement of one-half British content is reduced to one-quarter. The Order operates from April 15, 1933.

Pyrites Export from Spain

According to *Die Chemische Industrie* (May 13) the export of copper pyrites from Spain fell from 910,000 t. in 1929 to 352,200 t. in 1932. The decline in the case of iron pyrites was less marked. In 1932 109,200 t. of copper pyrites were exported to the United States, 92,600 t. to Holland, and 41,000 t. to Germany. Holland and France were the chief buyers of iron pyrites, each country taking over 300,000 t.

Japanese Alkali Industry

In the last year the production of sodium carbonate has risen from 93,300 t. to 165,000 t., and that of sodium hydroxide from 44,430 t. to 71,327 t. During the last 3 years the import of these two products by Japan has dropped to about one-third, and it is estimated that by the end of 1934 there will be a surplus for export. (Die Chemische Industrie.)

COMPANY NEWS

W. J. BUSH & CO., LTD.

At the annual general meeting of the company (cf. last week's JOURNAL for financial results) the chairman, Mr. J. M. Bush, stated that the increase in the net profit could be largely attributed to the successful development of the company's business in fine chemicals. The output of some chemicals would be interrupted during the current year on account of the explosion at the Mitcham works; this was, however, fully insured, the insurance including a loss of profits policy.

With regard to overseas business, both the American and Canadian subsidiary companies showed a decline in net profits, but possessed substantial surpluses, whilst the Australian branch showed a very satisfactory recovery.

The Rt. Hon. Lord Hayter was re-elected a director of the company.

A. BOAKE ROBERTS & CO., LTD.

The company reports a profit for the year ended March 31, 1933, of £70,542, after provision for depreciation and interest on debentures, as compared with £52,257 in the previous year. After making allowance for income tax etc., the net profit is increased from £32,096 in 1931—32 to £46,191 in 1932—33. It is proposed to pay a final dividend of 1½% on the ordinary shares, bringing the total for the year to 8½%, an increase of 1½% compared with last year. The balance carried forward is £53,157.

STANDARD CHEMICAL CO.

The Standard Chemical Co. of Canada reports a net loss for the year ended March 31 of $177,104, as compared with a loss last year of $16,109.

ASSOCIATED DYERS & CLEANERS

At the annual general meeting of the company held recently Mr. Frank Eastman and Mr. W. Gillespie were elected and Mr. Leonard Rigg was re-elected to the board of directors. Mr. J. W. Murray, chairman, retired from the board at the conclusion of the meeting. It was decided that Mr. Drysdale would continue to serve the company as joint managing director.

B. LAPORTE, LTD.

The accounts of the company, chemical manufacturers of Luton, show a profit for 1932 of £52,068, which is an increase of nearly £25,000 as compared with the previous year. The ordinary dividend is maintained at 10%, the same as last year, and an additional bonus of 2½% is being distributed. After making all necessary provisions the balance carried forward is increased from £15,464 to £18,182.

The report of the company states that a good volume of business was maintained last year, both at home and abroad, with the margin on export business higher that usual. In view of the importance of assuring supplies of barytes, the company has acquired control of the Shropshire firm Malehurst Barytes Co., Ltd., a loan of £16,000 having been made to the Malehurst company as a first charge on the assets.

AMALGAMATED METAL CORPORATION

The accounts of the corporation show a net profit for 1932 of £190,338, as compared with £202,132 in 1931. Dividend on the ordinary capital (£4,435,792) is maintained as last year at 3%.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., June 9, 1933, p. 489).

RUBBER CHEMICALS

Cadmium Sulphide.—2s. 10d.—3s. 2d. per lb.
Carbon Black.—3¼d.—5d. per lb., ex wharf.
Vermilion, pale or deep.—4s. 4d.—4s. 6d. per lb.

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Paraldehyde.—1s. 4d.—1s. 10d. per lb.

ESSENTIAL OILS

Sandalwood, Mysore —30s. per lb. 90/92%, 20s. per lb. Australian, B.P. and French Codex, 92/95%, 15s. 6d. per lb.

PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 33,128 (1932). Girdler Corp. Removing and recovering acidic gases from gas mixtures.

33,232 (1932). Visser. Preparing dry powder from emulsions and solutions.

33,291 (1932). Sega. Depurating filter.

33,310 (1932). Ufer Ingenieurges. Liquid stirring and separating apparatus.

33,417 (1932). Naaml. Venn. Octrooien Maats. Activit. Purification of liquids by means of activated carbon.

II. 30,283 (1932). Standard Oil Development Co. Manufacture of acetylene and organic compounds therefrom.

31,930 (1932). Standard Oil Co. Treatment of oils.

III. 19,035 (1932). Schering-Kahlbaum A.-G. Catalyst for conversion of terpenes.

30,283 (1932). Standard Oil Development Co. *See* II.

33,127 (1932). Girdler Corp. Preparation of basic organic nitrogen compounds.

33,272 (1932). I. G. Farbenind. Manufacture of α-chlor-ethyl-benzene and related compounds.

33,278—9 (1932). I. G. Farbenind. Manufacture of *ortho*-aminoaryl-alkylsulphones, ortho-aminoaryl-aralkylsulphones, and azo dyestuffs therefrom.

IV. 33,273 (1932). I. G. Farbenind. Manufacture of azo dyestuffs.

33,278—9 (1932). I. G. Farbenind. *See* III.

V. 32,996 (1932). Heberlein & Co. *See* VI.

33,387—8 (1932). Du Pont de Nemours & Co. Manufacture of cellulose derivative compositions.

VI. 32,996 (1932). Heberlein & Co. Improving cellulose-containing fabrics, threads, etc.

VIII. 14,884 (1933). Alterra A.-G. Sintered magnesia and refractory materials containing it.

X. 33,468 (1932). Gen. Electric Co. Thermal or thermochemical treatment of metal wire etc.

33,556 (1932). Deuts. Edelstahlwerke. Production of hard alloy bodies.

XI. 30,022 (1932). Miguet and Perron. Electrothermic reduction of raw materials.

XII. 33,547 (1932). Deuts. Gold- u. Silberscheideanstalt. Manufacture of soaps having a disinfecting action.

XIV. 33,435 (1932). Frölich. Producing a hardened surface on rubber goods.

XIX. 33,400—1 (1932). Kasper. Treating coffee beans.

XX. 33,461 (1932). Hinz. Medical remedy.

XXI. 30,290 (1932). I. G. Farbenind. Colour photography.

33,548 (1932). Mimosa A.-G. Drying and glazing photographic prints.

XXIII. 33,417 (1932). Naaml. Venn. Octrooien Maats. Activit. *See* I.

33,547 (1932). Deuts. Gold- u Silberscheideanstalt. *See* XII.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Australia:* Aromatic chemicals, synthetic perfumery compounds (801A). *Brazil:* Iron and steel, copper (829). *British India:* 9340 lb. chloroformum B.P., 42 lb. cocaine hydrochlor etc., 21,700 gallons cresol saponified, tablets: hypodermic, medicinal, and disinfectant, iodum and iodoformum B.P. (Director-General, India Store Department, Belvedere Road, Lambeth, S.E.1). *Canada:* Anæsthetic ether (in tins), gelatine capsules, creosote derivatives (804). *Egypt:* Tinplate (827); Diesel pumping set (G.Y. 12,655). *Italy:* Markets for tinplate (G.Y. 12,618). *Morocco (French Zone):* Linseed oil, soya bean oil (825). *Poland:* Fats and oils for soap-making, resin, shellac, industrial chemicals (819); Pharmaceutical and technical chemicals, essential oils (821); Bakelite, bakelite powder and tubes, galalite, cellophane (823). *Sweden:* Iron and steel bars and section, tin, zinc sheets and non-ferrous metals (824).

Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during May, has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 733, of which 655 were from merchants or importers. To these should be added the one case outstanding on April 29, making a total for the month of 734. These were dealt with as follows: granted, 717 (all dealt with within 7 days of receipt); referred to British makers of similar products, 14 (all dealt with within 7 days of receipt); outstanding on May 31, 3.

Of the total of 734 applications received, 731 or nearly 100% were dealt with within 7 days of receipt.

Change of Address

The office and laboratory of the Special Officer, Lac Inquiry, at Saundersfoot, S. Wales, have been closed down. The office is now at India House, Aldwych, London, W.C.2, and the laboratory at The Point Research Station, Teddington, Middlesex.

New I.C.I. Dyestuffs

Imperial Chemical Industries, Ltd. has recently added an attractive colour to its range of Dispersol dyestuffs in Dispersol Fast Red RS Paste, which is suitable for dyeing all forms of acetate silk, giving bright yellowish red shades which possess good fastness to light, washing and perspiration. It is suitable for producing both self and compound shades when fastness to hot pressing and marking-off is desired. It should be of special interest also for the dyeing of acetate silk goods for subsequent discharging, as good whites are obtained by the formosul-calcium and formosul-zinc sulphocyanide processes, an example of the attractive effect obtained by the latter method being shown on the colour-card. It possesses very good affinity for the acetate silk fibre and can be dyed without assistants in the dye bath, whilst it is unaffected by the presence of acids or alkalis necessary for the dyeing of other textile fibres.

Breadmaking Congress Report

An account of the papers read at the International and Scientific Breadmaking Congress held in Rome in June, 1932, and discussions on the papers, has been published by the Federazione Nazionale dei Panificatori, Piazza Sonnino, 2, Rome, and is available in English, German, French, Italian, and Spanish at the price of 38 l. inclusive of postage.

Forced Air Circulation Furnaces

Manufacturers whose products demand heat-treatment under close control will be interested in a new leaflet just issued by Wild-Barfield Electric Furnaces, Ltd., North Road, Holloway, London, N.7. This leaflet describes in detail the construction, operation, and advantages of the Wild-Barfield forced air electric furnaces which were originally placed on the market about five years ago. The various improvements which have since been made have increased their popularity, and the type described in this new leaflet embodies features developed by constant experimental work carried out during several years. The result is an equipment which has a greatly increased output, and an even greater uniformity of temperature than was hitherto considered possible. These equipments are in use throughout the world for tempering steels, secondary hardening of high speed steel, heat-treatment of aluminium alloys, and in fact, all treatments requiring temperatures up to 700° C. The furnace comprises, essentially, a heat-insulated chamber of cylindrical form with an inner, concentric cylinder of metal arranged to accommodate the work-basket. The heating elements are mounted in the annular space between the insulated wall and the container, the latter serving to prevent direct radiation of heat on to the charge and to confine the circulating air to a definite path. The use of a centrifugal fan constitutes an important feature, whilst the circulation is continuous, no fresh air being drawn into and no hot air expelled from the chamber. The whole of the heat generated by the elements is thus conserved and imparted to the charge as rapidly as it can be absorbed by the latter.